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ABSTRACT

Presented are the findings of a survey of students who are, or have been, participants in the King Foundation Forgivable Loan Program in Texas for preservice secondary mathematics or science teachers. Data on the number of respondents in the program and not in the program, and their reasons for staying or leaving (that is, teaching mathematics or science or not teaching those subjects) are given. The loan program seems to have had only a modest influence on students' decisions to become secondary mathematics or science teachers, although several did report such an influence. Perhaps more important, informal written comments indicate the program encouraged some others to stay with their original decision. The program's strongest influence may be on the retention rate of new teachers. Moreover, the dropout rate from teaching is low. (MNS)

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ATTRACTING AND RETAINING SECONDARY MATHEMATICS AND SCIENCE TEACHERS

Presented at the 35th Annual Conference for the Avancement of Mathematics Teaching

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ATTRACTING AND RETAINING SECONDARY MATHEMATICS AND SCIENCE TEACHERS

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Introduction

The purpose of this paper is to present the findings of a survey of students who are, or have been, participants in the King Foundation forgivable loan program for pre-service secondary mathematics or science teachers. The last few years have brought a growing shortage of qualified mathematics and science teachers for secondary schools in the United States (Blosser, 1984; Lashier & Ryoo, 1984; Odell & Fifer, 1985; Olstad and Beal, 1984; Sobel, 1983). Recent reports suggest that this shortage -- particularly of mathematics teachers -- will continue in Texas for at least the next five years (Texas Education Agency, 1986). Various plans have been proposed to attract and hold qualified science and mathematics teachers (Baker, 1986; Beal et al., 1985, 1986; Clark et al., 1984; The College Board, 1986; Engel and Nall, 1984; Harder, 1986; Levin, 1985; Rush, 1983; Spector, 1984; Woo, 1985). Twenty-eight states have adopted forgivable loan programs to attract students to teacher education, with many of them emphasizing mathematics and science teaching. The loans may be forgiven if the student teaches for a specified period of time after graduation. The success of these forgivable loan incentive programs appears to be uncertain at this time (Rodman, 1985).

Procedures

Since 1983, the King Foundation of Dallas has offered $2000 per annum forgivable loans for eligible students at four institutions of higher education in Texas, with a limit of five new students per year at each institution. The students must be preparing to teach mathematics, physics, chemistry, or a composite physical science at the middle school or high school level. Students must maintain a 3.00 grade point average. A year of the loan is forgiven for each year a graduate teaches in his or her field. In June of 1987 a questionnaire was sent to all 86 King Scholars who had participated in the forgivable loan program for at least one semester. The questionnaire, which had been piloted the year before with King Scholars at one of the four colleges, attempted to gather information about the students' selection of teaching fields, their persistence in the program, the ways in which they learned about the program, and their attitudes toward aspects of the program and its

effectiveness. A follow-up to the initial mailing brought the response rate to 73.3% (63 respondents). Five more questionnaires were received too late to be included in the analysis. There was no significant difference in response rate between the four institutions.

Findings

Twenty five (39.7%) of the respondents are still King Scholars while 38 (60.3%) are not. Of those who are no longer in the program, 21 (33.3% of the respondents) have graduated and are now teaching. Following are reasons others left the program, the number giving each reason, and the percentages of the total respondents:

Did not want to become a teacher	2 (3.2%)
Wanted to teach subject other than science or math	2 (3.2%)
Decided to teach at elementary school level	1 (1.6%)
Became ineligible because of g.p.a.	7 (11.1%)
Transferred to another college	2 (3.2%)
Other reasons	3 (4.8%)

Mathematics is clearly the most frequent choice of teaching field for King Scholars. Fifty respondents (79%) report at least one of their teaching fields is mathematics. Of those, 28 (44% of the sample) have a single teaching field in mathematics. Only 3 other respondents reported a single teaching field, one in chemistry (1.6%), one in physics (1.6%), and one in composite physical science (1.6%). Twenty eight of the respondents have 2 teaching fields, 2 reported having 3 teaching fields (math, physics, and other), and 2 reported 4 teaching fields (math, chemistry, physics, and other). Presumably the other field for those reporting 3 or 4 fields is physical science since combined physics and chemistry teaching fields would bring a student very close to certification in that composite field. The breakdown for other teaching fields is as follows:

chemistry	15 (23.8%)
physics	10 (15.9%)
other	22 (34.9%)

While biology, physical science, and earth science were often mentioned as other teaching fields, English was mentioned by several.

When asked how they had learned about the King Scholar forgivable loan program, respondents cited a variety of sources, but most frequently indicated a college instructor. Following are the number and percentages for each source. Percentages total more than 100% because some respondents named more than one source.

high school counselor	8 (12.7%)
financial aid officer	11 (17.5%)
college recruiter or admissions officer	7 (11.1%)
friend	4 (6.4%)
advertisement	4 (6.4%)
college instructor	24 (38.1%)
other	9 (14.3%)

Three questions were asked to determine the influence the program may have had on the participants' choice of college, career, and teaching field(s). The current and former King Scholars were asked to respond on a scale of 1 to 5 with 1 indicating "not at all," 3 "moderately," and 5 "greatly." Question 6 asked, "Did the King Scholars program influence your selction of the college/university you decided to attend?" Responses ranged from 1 through 5 with a mean of 2.13 and a standard deviation of 1.51. For question 7," Did the King Scholars program influence your decision to pursue a teaching career?" responses again ranged from 1 through five with a mean of 2.24 and standard deviation of 1.41. Respondents were then asked in question 8, "Did the King Scholars program influence your decision to pursue at least one teaching field in mathematics, chemistry, or physics?" The response range was 1 through 5, the mean was 2.16, and the standard deviation was 1.39.

Question 9 asked, "In your opinion, how effective is a forgivable loan program such as the King Scholars program in attracting and holding qualified students into the teaching profession?" Responses were on a scale of 1 through 5 with 1 indicating "ineffective," 3 "moderately effective," and 5 "greatly effective." Responses ranged from 2 through 5 with a mean of 4.1 and a standard deviation of .87.

It was hypothesized that the choices of career and teaching fields by those who left the program before graduating may

have been more influenced by the forgivable loan than the choices of those who persevere in the program. Responses to questions 6, 7, 8, and 9 from those who left the program or became ineligible were compared to those of students who are in or have completed the program. Following is a breakdown of those responses:

	Out	In or graduated
Question 6 college choice	range= 1-5	range= 1-5
	$\bar{X}$= 2.18	$\bar{X}$= 2.07
	s= 1.38	s= 1.57
Question 7 career choice	range= 1-5	range= 1-5
	$\bar{X}$= 2.29	$\bar{X}$= 2.22
	s= 1.45	s= 1.41
Question 8 teaching field choice	range= 1-5	range= 1-5
	$\bar{X}$= 2.29	$\bar{X}$= 2.09
	s= 1.57	s= 1.33
Question 9 program effectiveness	range= 2-5	range= 2-5
	$\bar{X}$= 3.71	$\bar{X}$= 4.26
	s= .92	s= .80

Finally, respondents were asked what if any aspects of the King Scholars forgivable loan program they would like to see changed. Following is a breakdown of the responses:

semester reports to the King Foundation	5 (7.9%)
g. p. a. requirements	4 (6.4%)
lack of probationary period for g. p. a.	17 (27.0%)
teaching fields	10 (15.9%)
annual amount of the forgivable loan	6 (9.5%)
others	4 (6.4%)

Discussion

The retention rate of the program appears to be fairly good. Seventy-three percent of the respondents are still in or have graduated and are teaching. This is well above the national average for retention in college. Of course, what constitutes "good" retention for a program such as this is arguable. Since the four institutions provided students' names and addresses in different formats, it was not possible in all instances to determine who were current or graduated King Scholars and who had dropped from the program. One would suspect a strong tendency for "drop outs" to not return the questionnaire. However, information from the two institutions that indicated each student's status did not clearly confirm this trend. A follow-up of nonrespondents (20.1%), along with reanalysis of the data including the few late respondents (5.8%), may provide a firmer basis for conclusions.

The program obviously attracts more students to mathematics teaching (79.0%) than to the other designated fields. This confirms the findings of the pilot study and of some informal comments that the King Scholars forgivable loan program is viewed as mathematics teaching program. Chemistry is a choice of 23.8%, and 15.9% are pursuing physics. (Percentages total more than 100% because many students have more than one teaching field.) This apparent imbalance, though, may not be a problem. In grades 7-12, there are more courses and sections offered in mathematics than in physics or chemistry. It is interesting to note that 34.9% of the respondents indicate "other" as a teaching field. As mentioned above, English and history are listed as other fields as well as physical science, earth science, etc., indicating that diversification is possible within the confines of the program.

It appears that many of the King Scholars learned of the program after admission. "College instructor" was the most frequently mentioned source of hearing about the forgivable loan program (38.1%). Fifteen (23.8%) named a clearly pre-admission source -- high school counselor or college recruiter/admissions officer. In short, students learned of the program in a variety of ways, but on-campus "recruiting" by professors seems to be the single greatest source of King Scholars.

Overall, it does not appear that the forgivable loan program strongly influenced the respondents' choices of college, career, and teaching fields. The means of 2.13, 2.24, and 2.16 respectively are on the low end of the 1-5 scale. However, a fair percentage of current or graduated scholars reported a strong influence on their decisions. Of that group, the following percentages marked 4 or 5:

Question 6, college selection	21.7%
Question 7, career selection	21.7%
Question 8, teaching field(s)	17.4%

Two-tailed t tests revealed no statistically significant differences between current or graduated King Scholars and those who left the program in responding to questions 6, 7, and 8.

Respondents rated the general effectiveness of a forgivable loan program such as this one to be very high, a mean of 4.1 on a 1-5 scale. Only one of the 63 rated it as less than moderatley effective and none thought it ineffective. Apparently, participants have strongly positive feelings about the program despite the fact that most say it was not a strong influence in their decision to become a secondary math or science teacher. Not surprisingly, those who left the program rated its effectiveness lower (3.71) than those who are in or have completed (4.26). This difference is significant at the $p<.05$ level using a two-tailed t test.

Students' main complaint (27.0%) about the program was the lack of a probationary period if the student fell below 3.00. One of the institutions, with the permission of the King Foundation, has implemented a probationary policy. There was no other clearly salient trend of objections or suggestions for changing the program, though 15.9% would like to see the choice of approved teaching fields expanded.

Recommendations

While the King Scholars forgivable loan program seems to have had only a modest influence generally on students' decisions to become secondary mathematics or science teachers, several did report such an influence. Perhaps more important, informal written comments volunteered by some students indicate the program encouraged them to stay with their original decision. The program's strongest influence may be on the retention rate of new teachers. Research shows that the "drop out" rate for teachers declines sharply after their fourth year of teaching. A follow up of King Scholar graduates over the next few years would be able to evaluate the holding power of the forgivable loan. Initial information, though incomplete at this point, suggests that all those who graduated as King Scholars are now teaching. The same cannot be said for teacher education graduates across the board.

It is hoped that this forgivable loan program may be continued. If it is, it is recommended that the institutions increase their efforts to recruit qualified

high school students beginning before the senior year. These should be cooperative efforts involving the schools of education, college departments of mathematics and the sciences, admissions offices, counselors, high school mathematics and science teachers, future teachers groups, and professional organizations. A distressing problem that must be taken into account when recruiting students for the King Forgivable Loan Program is the appalingly low percentage of Texas high school graduates who have taken Algebra II. Odell and Fifer (1985) discovered that only 17% to 18% complete Algebra II, compared to a national average of 49% This data suggests that unless recruiting efforts for the King Forgivable Loan Program are expanded aggressively out of state, or unless the number of Texas high school students taking Algebra II and beyond rises suddenly and dramatically, the pool of potential candidates will remain small.

There is one caveat. The program is based on the premise that there will continue to be a shortage of certified secondary mathematics and science teachers. Recent data on teacher supply and demand have often been unreliable and contradictory, but there are some current research efforts that may yield a clearer picture of the supply-demand balance (Edelfelt, 1986; Rumberger, 1985). That research should be monitored, as well as informal reports from school district personnel officers who recruit at the participating institutions. While it seems highly unlikely at this time that we would educate more King Scholars than could easily find jobs, we should be careful to avoid that situation in the future.

Finally, we must recognize that if we wish to increase the size and quality of the pool of certified teachers in math and science -- or any fields --, then hold them in the profession, improvements and innovations in pre-service education can be only part of the process. As Irene K. Spero said before a Congressional panel in the summer of 1985, " The ability to attract the best and the brightest teachers will depend first, on making teaching a more desirable career and, only secondly, on incentives such as loan forgiveness." (Rodman, 1985).

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